Patent Application of

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For

A ~~PORTABLE~~ VESSEL FOR CONTACTING FLUID PHASES ~~AIR CLEANING, HEATING, AND COOLING APPARATUS~~

~~CROSS-REFERENCE TO RELATED APPLICATIONS~~

~~Not applicable.~~

~~STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT~~

~~Not applicable.~~

~~REFERENCE TO A MICROFICHE APPENDIX~~

~~Not applicable.~~

FIELD OF THE INVENTION

The present invention relates to a vessel for contacting fluid phases consisting of a fluid guiding body shaped as an auger with a stem and a hollow blade, confined within a

 as to a vessel wherein a stream of vapor or gas is

contacted with a liquid to transfer mass within the vapor or gas stream into the liquid stream or to transfer heat to or from the vapor or gas. A liquid enters the hollow blade through a liquid inlet opening. A vapor or gas enters the conduit formed by the blade of the auger shaped fluid guiding body revolved about the stem and the inside wall of the housing through an inlet opening in the housing. The vapor or gas moves through the conduit and is contacted throughout the contacting zone by the liquid exiting the blade through perforations in the bottom of the blade. The contacted vapor or gas and the used liquid are discharged separately through a vapor or gas discharge opening and a liquid discharge opening, respectively.

BACKGROUND OF THE INVENTION

Numerous mechanisms have been devised to contact and subsequently separate a vapor or gas and a liquid for the purpose of cleaning or conditioning the vapor or gas. Typically, the vapor or gas and liquid flow countercurrently to one another and the frictional drag between the flowing phases and devices such as splash plates, spray nozzles, or mesh screens disperse the liquid into very small droplets to promote mixing of the phases.

Muhr 6 117 219 describes an arrangement for washing and humidifying air with water using a water guiding body shaped as a hollow stone sculpture. The inside and outside surfaces of the body are completely wetted by distributing the downward flow of the water over the inside and outside surfaces of the body using crevices and grooves in the surfaces of the body to maximize the surface area between the air and water phases so as to promote the transfer of water between the phases. Splash plates on the inner surface of the hollow body and an insert body comprised of wire mesh or perforated disks disintegrate the water flowing downward into small droplets to promote mixing of the air and water phases.

Sykes 2 817 415 describes a vertically disposed cylindrical tower type of apparatus for countercurrently contacting fluid phases which uses a helical baffle to direct liquid downward and toward the center of the tower to promote mixing of the liquid within the vortex of a vapor flowing through a helical pathway upward through the contacting zone. Other vertically disposed cylindrical towers utilizing devices such as contacting materials, splash plates, spray nozzles, and peforated surfaces within the vessel to promote contacting of the vapor

and liquid phases are common. Generally the vapor or gas makes a single pass through the contacting zone. Throughout most of the contacting zone the vapor or gas is contacted by liquid that has contacted preceding vapor or gas.

~~Currently, indoor air cleaning systems primarily use filters to directly clean indoor air and all air filtering systems suffer from a number of disadvantages. They do not maximize the proportion of air in a room that is cleaned because their low-height designs do not optimally facilitate the circulation of the air in the room. They operate at low air flow rates and do not optimize cleaning performance with respect to the number of times that the air in the room is exchanged over a given amount of time. They lack scalability because an air cleaning system using a filter to directly clean air is limited in design to the cross-sectional area of the filter and to the maximum flow rate of air that the filter can handle. Further, indoor air cleaning systems do not provide the means to heat or cool the air that is being cleaned. Finally, expensive filters must be replaced frequently because the amount of air being cleaned decreases over time as impurities are collected by the filter.~~

OBJECT OF THE INVENTION

The objects of the present invention are to thoroughly contact a gas or vapor with a clean liquid throughout a fluid contacting zone, to increase the residence time of a vapor or gas within a cleaning vessel, to improve the scalability of a fluid contacting and separation vessel, and to reduce the cost to produce such a vessel.

~~BRIEF~~ SUMMARY OF THE INVENTION

The present invention achieves these objectives by a fluid contacting vessel containing an auger shaped fluid guiding body comprising a stem and a blade extending through most or all of the height of a vertically disposed housing. Vapor or gas enters the conduit formed by the blade revolved about the stem through a conduit in the housing at the vapor or gas inlet end of the vessel and flows upward along a helical flow path through the conduit and exits the vessel.

Liquid enters the hollow blade of the fluid guiding body through a conduit in the blade at the liquid inlet side of the vessel and is discharged through perforations in the bottom of

the blade into the vapor or gas stream moving through the vessel. The used liquid flows down the upper surface of the blade of the fluid guiding body and is discharged from the vessel. This configuration for contacting a vapor or gas stream with a liquid ensures that the vapor or gas passing through the vessel is contacted thoroughly with clean liquid throughout the fluid contacting zone.

Because the liquid is dispersed thoroughly into the vapor or gas from the perforations in the bottom of the blade, there is no need to operate in a countercurrent manner or to employ devices such as splash plates or spray nozzles to disperse the liquid into the vapor or gas stream. The perforations in the bottom of the blade of the fluid guiding body may be small so as to deliver a fine mist to the vapor or gas stream so that fine matter contained within the stream is wetted and so that heat may be transferred to or from the vapor or gas phase. The perforations may be larger in order to deliver larger liquid droplets to the vapor or gas phase so that wet fine matter within the vapor or gas is contacted by larger liquid droplets and is transferred from the vapor or gas stream to the used liquid stream. The perforations may be designed to deliver the liquid to the vapor or gas phase in a generally concurrent or generally countercurrent manner.

~~My invention removes impurities from indoor air by washing the air with water. The used water is subsequently cleaned, heated or cooled, and reused. Several objects and advantages of my air cleaning system are to maximize the proportion of air in a room that is cleaned; to operate at a high capacity; to provide greater scalability to for an air cleaning system; to provide the means to heat or cool the air that is being cleaned; and to continuously operate at the optimum capacity. Further objects and advantages are to reduce the costs of operating and maintaining an air cleaning system and to reduce indoor heating and cooling costs.~~

~~REFERENCE NUMERALS IN DRAWINGS~~

~~2~~	~~vent~~	~~4~~	~~air washing mechanism~~
~~6~~	~~media container~~	~~8~~	~~reservoir~~
~~10~~	~~air slots in vent~~	~~12~~	~~hole in side near bottom of vent~~
~~14~~	~~notch with thread~~	~~16~~	~~notch with groove~~
~~18~~	~~stem~~	~~20~~	~~blade~~
~~22~~	~~conduit~~	~~24~~	~~perforations in hollow portion of blade~~

~~26~~	~~grates in solid portion of blade~~	~~28~~	~~perforations in mechanism~~
~~30~~	~~slot in annulus~~	~~32~~	~~annulus~~
~~34~~	~~hole in mechanism~~	~~36~~	~~water line~~
~~38~~	~~perforations in bottom of container~~	~~40~~	~~hole in reservoir~~
~~42~~	~~hole in reservoir~~	~~44~~	~~valve~~
~~46~~	~~removable access panel~~	~~48~~	~~slots in reservoir~~
~~50~~	~~fill line in reservoir~~	~~52~~	~~grooves along main axis of surface~~

BRIEF DESCRIPTION OF THE ~~SEVERAL VIEWS OF THE~~ DRAWINGS

The present invention may be better understood by referring to the attached figures wherein an embodiment of the invention is illustrated.

FIG. **4** shows a partially cut-away view of an embodiment of the present invention.

FIG. **2** is a view taken along the section I-I of FIG. **4**.

FIG. **7** is a view taken along the section II-II of FIG. **4**.

~~The present embodiment of my invention is presented in Figs 1 through 6. Fig 1 shows the rear view of the elements of the air washing system interconnected. The front and side views of the system are unremarkable. Fig 2 shows the top view of the air washing system and denotes the view of the cross sections presented in Figs 3 through 6. Fig 3 shows the vent 2; Fig 4 shows the air washing mechanism 4 ; Fig 5 shows the media container 6; and Fig 6 shows the reservoir 8.~~

~~DETAILED~~ DESCRIPTION OF THE ~~INVENTION~~ PREFERRED EMBODIMENT

~~As shown in Fig 1 the elements are generally. To improve visual appeal and to promote assembly, the exterior surfaces of the elements contain grooves 52 along the main axis of the assemblage. An element is connected to another element by threading a contiguous thread on a notch in the element through a contiguous groove in a notch in the other element.~~

~~An air vent 2 (Fig 3) distributes cleaned air upward and outward throughout 360 degrees to promote circulation of air within a room. The top of the vent 2 is solid and there are slots 10 in the vent 2. The power cord for a fan (not shown) passes through a hole 12.~~

~~The bottom of the vent 2 is open and conforms to the uniform means of connecting elements of the system 14 and connects onto an air washing mechanism 4.~~

As shown in FIG. **4**, ~~T~~the ~~air washing mechanism 4 (Fig 4)~~ fluid guiding body contains a ~~solid~~ stem **18** and a ~~contiguous~~ continuous hollow blade **20** throughout most or all of the length of the stem **18** wherein the revolutions of the blade **20** about the stem **18** form a conduit **22**. The inner edge of the blade **20** continuously contacts the outer surface of the stem **18** and the outer edge of the blade **20** is continuously adjacent to the inner surface of the housing **3**, as is indicated in the figures. The vessel housing **3** is cylindrical and contains a structure **5** to support the fluid guiding body.

To simplify the description, it will be considered that the vessel presented by the figures is operated on a gas phase of air and a liquid phase of water. Air enters the ~~conduit **22**~~ vessel through a ~~slot~~ vapor or gas inlet **30** in the wall of the housing **3** ~~a cocentric annulus **32** in the stem **18**~~ at the air inlet side of the vessel and moves ~~Cleaned air exits the mechanism 4~~ through the contacting zone via the conduit **22** ~~to the vent 2~~ and exits the vessel.

Water enters the blade **20** through a liquid inlet **34** in the blade **20**. ~~One revolution of~~ Tthe blade **20** is hollow and ~~both~~ the top ~~and the bottom~~ of the blade **20** is ~~are~~ solid ~~so that water is contained~~ and the bottom of the blade **20** has perforations **24** so that water flows from the blade **20** into the conduit **22** by the forces of gravity and the pressure of the water within the blade **20**.

~~Water enters the blade **20** through a hole **34** in the blade **20** water line 36. Two revolutions of the blade 20 are hollow and the top of the blade 20 is solid and the bottom of the blade 20 is perforated 24 so that water flows from the mechanism 4 by the forces of gravity and the static pressure head of the water. One revolution of the blade 20 is solid and grated 26 to allow the used water to trickle downward. And one revolution of~~ Tthe blade **20** terminates in a horizontal revolution of the blade **20** about the stem **18** which rests upon the support **5** of the housing **3** ~~contiguous with the mechanism 4~~ and has grates ~~perforations **28**~~ so that used water is discharged from the vessel. ~~The mechanism 4 prescribes to the uniform means of connecting elements of the system 14 and 16 and connects onto a container 6.~~

~~The container 6 (Fig 5) contains one or more media through which water from the mechanism 4 flows and wherein impurities removed from the air are removed from the water. Air passes through the container 6 through a cocentric annulus 32 to the mechanism 4. The top of the container 6 is open and the bottom of the container 6 is perforated 38 so that the cleaned water trickles from the container 6. The container 6 conforms to the uniform means of connecting elements of the system 14 and 16 and connects onto a reservoir 8.~~

~~The reservoir 8 (Fig 6) conforms to the uniform means of connecting elements of the system 16. The top of the reservoir 8 is open and the bottom of the reservoir 8 is solid to contain water. A pump inside the reservoir (not shown) pumps water through a line in the reservoir 8 through a hole 40 in the reservoir 8. The hole 40 and the line are coupled by a washer mechanism (not shown) to prevent leakage and the portion of the line protruding from the hole 40 in the reservoir 8 is the water line 36 to the mechanism 4. A quick-connect fitting is attached to the end of the water line 36. A water chiller (not shown) and a water heater (not shown) maintain the temperature of the water in the reservoir 8 within at a set temperature range so that the air cleaning system is able to continuously warm or cool the air that it cleans. The power cords exit the reservoir 8 through a hole 42 in the reservoir 8 and the cords and the hole 42 are coupled by a washer mechanism (not shown) to prevent leakage. A drain valve 44 can be used to manually withdraw water from the reservoir 8. A removable access panel 46 provides access to the contents of the reservoir 8 without disconnecting the assembly. Slots 48 in the reservoir 8 allow air to be withdrawn from the room throughout 360 degrees. Air passes through the reservoir through a cocentric annulus 32 to the container 6. Cocentric fill lines 50 about the annulus 32 denote the maximum and minimum water levels for the reservoir 8. Portability is promoted by mounting wheels or coasters (not shown) along the bottom circumference of the reservoir 8.~~

~~Other embodiments of my invention will force the air through the system whereas the presented imbodiment pulls air through the system. Other embodiments of my invention will be designed to automatically maintain the appropriate water level in the reservoir and to impart a slight electrical charge to the water.~~

~~The manner of setting up and operating the system follows. First, place the reservoir 8 at the desired location in the room. Place a predetermined amount of water into the reservoir 8. Insert the access panel 46 into the reservoir 8. Place predetermined amounts of~~

~~pollutant removing media into the container 6. Place notch 14 of the container 6 into notch 16 of the reservoir 8 and thread the container 6 onto the reservoir 8. Place notch 14 of the air washing mechanism 4 into notch 16 of the container 6 and thread the mechanism 4 onto the container 6. Place notch 14 of the vent 2 into notch 16 of the mechanism 4 and thread the vent 2 onto the mechanism 4. Attach the water line 36 to the quick connect fitting 34 of the mechanism 4. Connect the power cords for the pump, fan, chiller, and heater to a power source. Turn on the pump. Turn on the fan. Set the theromstat to the desired temperature.~~

~~The manner of regularly maintaining the system follows. Turn off the pump, fan, chiller, and heater. Allow the water to trickle into the reservoir 8. Remove and clean the vent 2. Disconnect the water line 36 from the mechanism 4. Remove and clean the mechanism 4. Remove the container 6, discard the used media, and add new media to the container 6. Place the water line 36 into a drain, turn on the pump, and pump most of the water in the reservoir 8 into the drain. Turn off the pump. Discard the remaining water in the reservoir 8 using the manual valve 44. Add fresh liquid to the reservoir 8. Reassemble and operate the system as previously described.~~

~~From the description above, a number of advantages of my air cleaning system over systems that directly filter air are evident~~. The vessel ~~My invention~~ can ~~maximize the proportion of the air in a room that is cleaned; operate at a high capacity ;~~ improve the ~~provide greater~~ scalability ~~to~~ of a fluid contacting vessel ~~an air cleaning system~~, increase the period of time a vapor or gas is contacted with a liquid, and contact the vapor or gas with clean liquid throughout the contacting cycle. ~~provide a means to heat or cool the air that is being cleaned; and maintain a constant rate of clean air delivery~~. ~~The system can reduce the cost of operating an air cleaning system by using less energy, increasing the time of operation between regular maintenance, and decreasing the cost of replacement media. The system can also reduce indoor air heating and cooling costs.~~

~~My invention can be scaled to meet either household or commercial needs such as delivering clean, disinfected air in a medical setting or delivering warm or cool air to rooms, homes, offices, and buildings.~~ The present ~~My~~ invention can be used in many applications with the appropriate changes in the dimensions, materials of construction, and the configuration of the vessel ~~pollutant removal media, and the liquid(s) used~~. Although the description above contains ~~many~~ specifications, these should not be construed as limiting the

scope of ~~my~~ the invention but as merely providing an illustration of ~~the presently preferred~~ an embodiment of ~~my~~ the invention.

The dimensions of the vessel including the height and diameter of the vessel housing, the diameter of the stem, and the inside and outside diameters of the blade may be changed to account for the desired flow rate of the vapor or gas through the vessel.

The number of revolutions of the blade about the stem of the auger shaped fluid guiding body can be increased so that the period of time that the vapor or gas is within the contacting zone is increased.

Vapor or gas and liquid streams may enter and exit the vessel at other points within the vessel. The stem of the auger shaped fluid guiding body may be solid or it may have a central hollow core through all or part of its length.

The liquid may be warmer or cooler than the vapor or gas so that heat is transferred to or from the vapor or gas.

The blade of an auger shaped fluid guiding body may be solid with perforations with a liquid introduced onto the blade and entering the conduit through the perforations in the blade, or the blade may be hollow with the top of the blade being solid and the bottom of the blade being perforated with liquid introduced into the blade and entering the conduit through perforations in the bottom of the blade as shown in the drawings

What is ~~I~~ claimed is:

~~1. An air cleaning system the means to displace air, contact the displaced air with a liquid, exhaust the cleaned air, and discharge the used liquid; and the means to clean, displace, and direct a liquid whereby indoor air is cleaned.~~

~~2. The means to displace air, contact the displaced air with a liquid, exhaust the cleaned air, and discharge the used liquid of claim 1 wherein said means comprising a vent and an air washing mechanism.~~

~~3. The vent of claim 2 wherein said vent comprising the means to displace and distribute air.~~

~~4. The air washing mechanism of claim 2 wherein said mechanism comprising one or more surfaces wherein the surfaces form one or more wherein a liquid and the displaced air are contained, mixed, and separated.~~

5. ~~The means to clean, displace, and direct a liquid of claim 1 wherein said means comprising a container and a reservoir.~~

6. ~~The container of claim 5 comprising the means to clean and discharge a liquid.~~

7. ~~The reservoir of claim 5 comprising the means to displace and direct a liquid.~~

8. ~~The reservoir of claim 5 further comprising the means to heat and cool a liquid.~~

9. ~~The reservoir of claim 5 further comprising the means to impart a slight electrical charge to the liquid.~~

~~10. The reservoir of claim 5 further comprising a means of portability.~~

11. The method of contacting a vapor with a liquid comprising providing a substantially helical conduit by which a vapor passes through a contacting zone defined by a substantially vertically disposed substantially cylindrical housing, introducing the said vapor at one end of the said conduit, advancing the said vapor through the said conduit, said conduit having an outer lateral periphery defined by the wall of the said housing and an inner lateral periphery positioned between the axis of the said contacting zone and the said wall of the said housing whereby a flow path through the said contacting zone is created, introducing the said liquid into part or all of the said conduit into the said flowing vapor stream whereby the said liquid is dispersed into the said vapor stream throughout part or all of the said contacting zone, advancing the contacted liquid through the said conduit, withdrawing the said contacted vapor from the said contacting zone, and withdrawing the said contacted liquid from the said contacting zone.

12. The method of claim **11** wherein an auger shaped fluid guiding body comprising a stem and a blade extends through part or all of the length of the said axis of the said contacting zone, said blade having an outer periphery adjacent to the said wall of the said housing and an inner periphery adjacent to the said stem, said blade further comprising the means to disperse the said liquid into the said flowing vapor stream.

13. The method of claim **11** wherein the temperature of the said liquid is warm or cool in relation to the temperature of the said vapor whereby a temperature gradient between the said liquid and the said vapor is created and heat is transferred to or from the said flowing vapor stream.

A ~~PORTABLE~~ VESSEL FOR CONTACTING FLUID PHASES ~~AIR CLEANING, HEATING, AND COOLING APPARATUS~~

Abstract: ~~An air cleaning system comprising the means to displace air,~~ A vessel to contact ~~the displaced air~~ a vapor or gas with a liquid has a conduit through which a vapor or gas flows and is contacted by a liquid. A fluid guiding body confined within a vessel housing imparts a helical movement of the vapor or gas flowing through the vessel, disperses liquid into the flowing vapor or gas, and discharges the contacted vapor or gas and liquid separately from the vessel. Impurities in the vapor or gas stream are transferred from the vapor or gas stream to the liquid stream. Introducing a liquid having a temperature greater than or less than the temperature of the vapor or gas results in the transfer of heat to or from the vapor or gas.~~, exhaust the cleaned air, and discharge the used liquid; and the means to clean the used liquid, heat or cool the liquid, impart a charge to the liquid, and displace and direct the liquid whereby indoor air is cleaned and indoor air temperature is controlled.~~